

**REMARKS**

The remainder of this Amendment is set forth under appropriate subheadings for the convenience of the Examiner.

**Amendments to the Specification and Claims**

Applicants have amended the specification to update related application data.

Claims 1 and 16 have been amended to recite that a vitreous bond composition includes zinc oxide (ZnO) and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight. Support for this amendment can be found in the specification, for example, page 4, lines 26-27. Claim 16 has been further amended to define the unit of the amounts of porosity of a bonded abrasive tool. Support for this amendment can be found in the specification, for example, at page 6, line 17-19.

Claim 17 has been amended to correct a self-evident error.

No new matter has been added.

**Objection of the Specification**

The specification has been objected to for not updating the related application data. Applicants have amended the specification to update the related application data, thereby obviating the objection.

**Rejection of Claims 16-17 under 35 U.S.C. § 112, second paragraph**

Claim 16 has been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite, because there is no unit for the phrase “at least 15 percent.” Claim 17 has been rejected under 35 U.S.C. § 112, second paragraph, as being dependent from an indefinite base claim.

Claim 16 has been amended to recite that a bonded abrasive tool has a porosity of at least about 15 percent “by volume.” As amended, Claim 16 is now definite, particularly pointing out and distinctly claiming the subject matter which Applicants regard as the invention. Claim 17 is now also definite, because it depends from Claim 16, which is now definite, as amended.

Reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of Claims 1 and 3 under 35 U.S.C. § 102(b)

Claims 1 and 3 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,094,672 to Giles, Jr. *et al.* (hereinafter “Giles”).

In particular, the Examiner stated that Giles appears to teach all the claim elements of the claimed invention. Further, the Examiner stated that no patentable distinction is seen to exist between Giles and the claimed invention.

As amended, Applicants’ invention of base Claim 1 is directed to a method of making a bonded abrasive tool, comprising the step of selecting a fritted vitreous bond composition that includes ZnO and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight. The vitreous bond composition is combined with a superabrasive grain component and a filler component, and then the combined components are fired at a temperature in a range of between about 600 °C and about 850 °C.

Giles discloses a method of producing abrasive articles comprising an abrasive phase of alumina abrasive grits, a vitreous bond and inorganic, non-metallic bubbles, where the vitreous bond can contain ZnO and alkali metal oxides.

However, there is no disclosure or suggestion in Giles of a vitreous bond that includes ZnO and at least two alkali metal oxides ***in an amount in a range of between about five percent by weight and about fifteen percent by weight***. There also is no disclosure or suggestion in Giles of a method comprising the steps of selecting a vitreous bond composition that includes ***ZnO and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight***; and firing the combined mixture of the bond composition with ***a superabrasive grain component*** and a filler component at a temperature in a range of ***between about 600 °C and about 850 °C***. Although Giles discusses vitreous bond C that includes ZnO and alkali metal oxides, the amount of the alkali metal oxides is 2.5% by weight (see Column 5, lines 65-68), far less amount of Applicants’ claimed range of 5-15% by weight.

Therefore, the subject matter of Claim 1, as amended, is novel over Giles. Claim 3 depends from Claim 1. Thus, the subject matter of Claim 3 also is novel over Giles. Applicants respectfully request reconsideration and withdrawal of this rejection.

Rejection of Claims 1-8, 10-11, 13-14 and 16 under 35 U.S.C. § 103(a)

Claims 1-8, 10-11, 13-14 and 16 have been rejected under 35 U.S.C. § 103(a) as being obvious over Giles.

As amended, base Claims 1 and 16 relate to a method of making a bonded abrasive tool, comprising the steps of combining a superabrasive grain component, a filler component and a vitreous bond component, wherein the vitreous bond component includes ZnO and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight; and firing the combined components at a temperature in a range of between about 600 °C and about 850 °C.

In general, to make a vitrified bonded abrasive tool having a superabrasive grain, selection of a vitreous bond component is very important, because the bond component should be able to form a vitreous bond with the superabrasive grain to thereby have sufficient mechanical strength for grinding operations, and at a relatively low temperature so as not to cause any degradation of the superabrasive grain. For example, diamond begins to degrade at about 800 °C in an inert atmosphere and at much lower temperatures in air, unlike an alumina grain which can tolerate a higher bond firing temperature. Cubic boron nitride also is more thermally labile than an alumina grain. Also, it is much more difficult to wet the surface of diamond with a vitreous bond component, to form a diamond-to-glass bond, than it is to wet the surface of alumina grains.

Applicants' invention of Claims 1 and 16 solves this problem by providing a method of making a bonded abrasive tool having a superabrasive grain component at a relatively low firing temperature, but yet preserving excellent mechanical strength of the bond and grinding performance. As shown in Example 1 of the instant application at page 9, line 12 through page 11, line 12, and Table 2 at page 11, Applicants demonstrated that, at a firing temperature of 600 °C-850 °C, for a vitreous bond composition including ZnO and at least two alkali metal oxides in an amount of 5-15% by weight, a vitreous bond with a superabrasive grain component, such as diamond, having excellent mechanical strength can be formed, relative to a control that does not include ZnO. The vitreous bonded abrasive tool made by the invention also shows excellent grinding performance relative to a commercial wheel (see Example 2, shown at page 11, line 13 through page 14, line 3, and Tables 3-4 at page 12 and 13).

In contrast, there is no teaching in Giles of making a bonded abrasive tool that includes a superabrasive grain component by utilizing a vitreous bond composition that includes ZnO and at least two alkali metal oxides in an amount of 5-15% by weight, and firing the mixture of the bond composition and the superabrasive grain component at a temperature in a range of 600 °C-850 °C. One of ordinary skill in the art would not have expected, in view of the teachings of Giles, that firing a vitreous bond composition that includes ZnO and at least two alkali metal oxides in an amount of 5-15% by weight and a superabrasive grain component at a temperature in a range of 600 °C-850 °C would form a good vitreous bond, e.g., diamond-to-glass bond.

As discussed in the specification at page 1, line 17 through page 2, line 2, unlike alumina grains, it is extremely difficult to wet the surface of diamond with a vitreous composition to form a good diamond-to-glass bond. Although Giles discusses making a grinding wheel that contains cubic boron nitride abrasive grain by use of Bond C, Bond C includes only 2.5% by weight of alkali metal oxides, far less amount of Applicants' claimed range of 5-15% by weight. Also, although Bonds A and B of Giles include alkali metal oxides in an amount of about 12 % by weight and about 8 % by weight, respectively, when their mole percent is converted to the corresponding weight percent, they are demonstrated only with alumina grains in the absence of superabrasive grains (see Examples 1-12 of Giles at Column 6, line 24 through Column 9, line 20). Further, the firing temperatures for Bonds A and B are 2100 °F (about 1149 °C) and 2150 °F (about 1177 °C), respectively, which are far in excess of Applicants' claimed firing temperature range of 600 °C-850 °C. Giles does not disclose or suggest that a vitreous bond composition that includes ZnO and at least two alkali metal oxides in an amount of 5-15 % by weight would form a glass bond with a superabrasive grain component, e.g., diamond-to-glass bond, at a firing temperature of 600 °C-850 °C.

Therefore, the subject matter of Claims 1 and 16, as amended, is not obvious in view of Giles. Claim 2-8, 10-11 and 13-14 depend from Claim 1. Accordingly, the subject matter of these claims also is not obvious in view of Giles. Applicants respectfully request reconsideration and withdrawal of this rejection.

Rejection of Claims 15 and 17 under 35 U.S.C. § 103(a)

Claims 15 and 17 have been rejected under 35 U.S.C. § 103(a) as being obvious over Giles in view of U.S. Patent No. 6,093,225 to Itoh (hereinafter "Itoh").

The Examiner stated that one skilled in the art would have found it obvious to use abrasive mass according to Giles in any conventional manner, such as the one taught by Itoh, i.e., using the abrasive mass to be attached to a metal core.

Claims 15 and 17 depend from Claims 1 and 16, respectively. As discussed above, there is no disclosure or suggestion in Giles of the subject matter of Claims 1 and 16, as amended.

The secondary reference, Itoh, does not remedy the deficiencies of Giles. Itoh does not disclose or suggest the subject matter of Claims 1 and 16, as amended. For example, Itoh does not disclose or suggest selecting a vitreous bond composition that includes ZnO and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight; and firing the combined mixture of the vitreous bond and a superabrasive grain component, such as diamond and cubic boron nitride, at a temperature of in a range of between about 600 °C and about 850 °C.

Therefore, the subject matter of Claims 15 and 17 is not obvious in view of Giles and Itoh, either separately or in combination, and Applicants respectfully request reconsideration and withdrawal of the rejection.

#### Rejection of Claims 1 and 3-5 under 35 U.S.C. § 102(e)

Claims 1 and 3-5 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,702,867 B2 to Carman, *et al.* (hereinafter “Carman ‘867”) or WO 01/70463 to Carman, *et al.* (hereinafter “WO 01/70463”).

As amended, Claim 1 is directed to a method of making a bonded abrasive tool, comprising the steps of: selecting a fritted vitreous bond composition that includes ZnO and at least two alkali metal oxides in a range of between about five percent by weight and about fifteen percent by weight; firing the vitreous composition combined with a superabrasive grain component and a filler component at a temperature of in a range of between about 600 °C and about 850 °C.

The Carmen references disclose a vitrified-bonded abrasive tool that has a phosphorous oxide-containing, alkaliborosilicate vitrified bond composition, where alkaline earth oxides, such as CaO, MgO and BaO, along with ZnO, ZrO, F, CoO, MnO<sub>2</sub>, TiO<sub>2</sub> and Bi<sub>2</sub>O<sub>3</sub> can also be present. However, there are no specific examples of a firing temperature in the Carmen references falling within Applicants’ claimed range of 600 °C-850°C. In particular, all of the

examples in the Carmen references utilize a firing temperature of 900 °C (see Column 8, line 14 through Column 14, line 17). Also, the bond compositions demonstrated in the Carmen references do not include ZnO. Further, the compositions demonstrated by Carmen utilize only an alumina abrasive grain component, fine crystalline sintered alumina (MCA), in the absence of a superabrasive grain component (see Column 8, line 14 through Column 14, line 17).

There are no examples in the Carmen references falling into Applicants' claimed bond composition that includes ZnO and at least two alkali metal oxides in an amount of 5-15 wt%, and that is fired with a superabrasive grain component at a temperature of 600 °C-850 °C. Thus, there is no disclosure in the Carmen references of selecting a vitreous bond composition that includes *ZnO and at least two alkali metal oxides in an amount in a range of 5-15 % by weight*; and firing the combined mixture of the vitreous bond and *a superabrasive grain component*, such as diamond and cubic boron nitride, at a temperature of in a range of *600 °C-850 °C*, as claimed by Applicants.

Therefore, the subject matter of Claim 1, as amended, is not anticipated by the Carmen references. Claims 3-5 depend from Claim 1, and thus, the subject matter of Claims 3-5 is also not anticipated by the Carmen references. Therefore, Applicants respectfully request reconsideration and withdrawal of this rejection.

#### Rejection of Claims 1 and 3-5 under 35 U.S.C. § 103(a)

Claims 1 and 3-5 have been rejected under 35 U.S.C. § 103(a) as being obvious over the Carmen references, Carman '867 or WO 01/70463.

Although both Carmen references claim priority to U.S. Provisional Application No. 60/191,607, which was filed March 23, 2000, the references would only qualify as prior art under 35 U.S.C. § 102(e). However, the subject matter of the references and the instant invention were, at the time the instant invention was made, owned by the same company. Therefore, Carman '867 and WO 01/70463, *are not prior art* against the instant application under 35 U.S.C. § 103(c).

#### A. Common Ownership

The instant application is a divisional application of U.S. Application No. 09/934,261, filed August 21, 2001 (now U.S. Patent No. 6,609,963 B2). The parent application of the instant application and Carmen references, at the time the invention of the instant claims was made,

owned by “Saint-Gobain Abrasive Technology Company” in Worcester, MA, which was used to be called as “Norton Company.” According to record of the City of Worcester, Massachusetts, the *name* of Norton Company was changed to Saint-Gobain Abrasive Technology Company on October 20, 2000 (a copy of the record is enclosed as Exhibit A). The change of company’s name also was recorded in the Commonwealth of Massachusetts on June 1, 2001 (a copy of a letter by Secretary of the Commonwealth, Boston, MA is enclosed as Exhibit B).

Because the Carmen references do not qualify as prior art against the instant application under 35 U.S.C. § 103(c). Therefore, Applicants respectfully request withdrawal of this rejection.

Rejection of Claims 2, 6-14 and 16 under 35 U.S.C. § 103(a)

Claims 2, 6-14 and 16 have been rejected under 35 U.S.C. § 103(a) as being obvious over Carman ‘867 and WO 01/70463.

As discussed above, neither of the Carmen reference, namely Carman ‘867 and WO 01/70463, qualify as prior art against the instant application under 35 U.S.C. § 103(c). Therefore, Applicants respectfully request withdrawal of this rejection.

Rejection of Claims 15 and 17 under 35 U.S.C. § 103(a)

Claims 15 and 17 have been rejected 35 U.S.C. § 103(a) as being obvious over Carman ‘867 or WO 01/70463, both in view of Itoh.

The primary references, Carman ‘867 and WO 01/70463, do not qualify as prior art against the instant application under 35 U.S.C. 103(c).

Claims 15 and 17 depend from Claims 1 and 16, respectively. As discussed above, the secondary reference, Itoh, does not disclose or suggest the subject matter of Claims 1 and 16, as amended. For example, Itoh does not disclose or suggest selecting a vitreous bond composition that includes ZnO and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight; and firing the combined mixture of the vitreous bond and a superabrasive grain component, such as diamond and cubic boron nitride, at a temperature of in a range of between about 600 °C and about 850 °C.

Therefore, the subject matter of Claims 15 and 17 is not obvious in view of Carman '867, WO 01/70463 and Itoh, either separately or in combination, and Applicants respectfully request that this rejection also be withdrawn.

### SUMMARY AND CONCLUSIONS

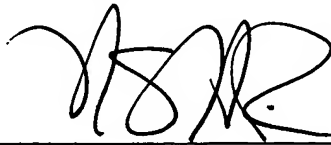
Base Claims 1 and 16 have been amended to recite that the fritted vitreous bond composition includes zinc oxide and at least two alkali metal oxides in an amount in a range of between about five percent by weight and about fifteen percent by weight. As discussed above, the subject matter of base Claims 1 and 16, as amended, is novel over Giles and the Carman references, Carman '867 and WO 01/70463. Also, the subject matter of base Claims 1 and 16, as amended, is not obvious in view of Giles and Itoh, separately or in combination. In addition, the Carman references are not prior art against the instant application under 35 U.S.C. § 103(c). Therefore, the subject matter of base Claims 1 and 16, as amended, is not obvious in view of Giles, Itoh and the Carman references, separately or in any combination.

As amended, Claim 16 is now definite, particularly pointing out and distinctly claiming the subject matter which Applicants regard as the invention.

Thus, in view of the above amendments and remarks, it is believed that as amended, base Claims 1 and 16 and Claims 2-15 and 27, dependent from base Claims 1 and 16, respectively, are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By 

N. Scott Pierce  
Registration No. 34,900  
Telephone: (978) 341-0036  
Facsimile: (978) 341-0136

Concord, MA 01742-9133

Dated: 10/1/01